Supporting Informal Meetings in Hospitals

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Abstract—Ambient Intelligence promotes a shift in computing which involves fitting-out the environments with devices to support context-aware applications. Health contexts require special attention. In these, decision making is important at any time and anywhere. In this work we present a context-aware scenario which supports informal meetings in hospitals. With RFID technology it is possible to obtain visualization of information, by just approaching the display. This is apart from, and in addition to, the services that it usually provides (location, presence, access, inventory, etc.). Another feature studied here is, a single interaction using some hardware buttons placed next the display. This makes it possible to control the sequence of notes to comment and the interaction possibilities.

Keywords—Ambient Intelligence, Context-Awareness, RFID, Visualization Mosaics.

I. INTRODUCTION

Hospitals are suitable contexts for the deployment of the vision of Ambient Intelligence seen in the 6th Framework Program of the European Community. Coordination and collaboration among doctors and nurses are musts. These people have to manage information about patients at any point in time and in any place. These kinds of environments are therefore ideal for building applications which support daily activities.

Efforts must concentrate on carefully placing artifacts to provide the information needed without any explicit interaction, if possible. So the concept of location is an important feature to consider. A single interaction is also expected if decisions are to be made quickly and effectively.

One of the most significant challenges in Aml/pervasive computing technologies is to create user-friendly interfaces which describe people in a given environment, recognizing and responding to the presence of each individual in a way that is not openly visible. Aml is based on three key technologies: Ubiquitous Computing, integrating microprocessors into everyday objects; Ubiquitous Communication; this allows these objects to communicate with each other and with users and natural interfaces interacting with the environment and to do so more easily and in a more personalized way. However, for this vision to become a reality it is necessary to handle the context-aware information. A. Dey defines context as “any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves.” [2]. This author also defines a context-aware system as “a context to provide relevant information and/or services to the user, where relevancy depends on the user’s task”.

In order to use context effectively it is necessary to identify certain types of context-aware information [3]. The user profile and situation are essential we refer to identity-awareness, location-awareness, time-awareness, activity-awareness and, finally, objective-awareness. All these types of awareness answer the five basic questions (Who, Where, What, When and Why) that provide the guidelines for context modeling.

Albrecht Schmidt [4][5] proposes a definition of Implicit Human Interaction (iHCI): “iHCI is the interaction of a human with the environment and with artifacts, which is aimed to accomplish a goal. Within this process the system acquires implicit input from the user and may present implicit output to the user”. Schmidt defines implicit input as user perceptions interacting with the physical environment, allowing the system to anticipate the user by offering explicit outputs. This is in accord with the idea that users should concentrate on the task and not on the tool. In addition, this author defines embedded interaction in two terms. The first one embeds technologies into artifacts, devices and environments. The second one, on a conceptual level, is the embedding of interactions in the user activities (task or actions) [6]. With these ideas in mind, our main goal is to achieve natural interaction, as the implicit interaction concept proposes.

The present work sets out the identification process as an implicit and embedded input to the system, perceiving the user’s identity and the information that the user carries by means of simple devices. This information together with the patients’ records makes it possible to offer visualization services to users. All the processes work by embedding interactions in users’ daily activities. In this case, just approaching the display is all that is required in order to obtain support for informal meetings between physicians and nurses. It is obvious that a single interaction is needed in this situation. This is possible with a set of hardware buttons placed next to the display. The control of notes for comment and the interaction possibilities.

In addition, all the services that this technology typically offers are put in practice in the hospital, that is, location,
access, presence, inventory, patient’s control in safety zones, etc. Finally, the privacy for comments from particular individuals is guaranteed. While the patients’ records are in the hospital database, the comments from every doctor or nurse are in their laptops and their bags. Furthermore, the information is transmitted at a distance of only a few centimetres, so security is another feature to take into account in this kind of technology.

Under the next heading we present the identification model for supporting informal meetings in hospitals. In section three the case study is presented. In this, the applied technology (RFID), the interaction and our contribution to visualization-based services are shown. Finally, related works and conclusions are set out.

II. MODELLING INFORMAL MEETINGS

It is obvious that in a hospital context there is a need to find the best way of controlling what is taking place in the interaction between doctors, nurses and the information on patients’ records. Unexpected and informal meetings are very common in rooms, corridors, and anywhere where two or more people are talking about hospital work. Consequently, it is important to support these activities by providing technology which allows people to access the information easily.

In considering these situations, we should analyze everyday activities in hospitals. When doctors or nurses meet, they have to think about which patients they want to talk about. As well as this, they have to remember the medical comments on the patient, along with his or her record, and do so accurately. Since a typical characteristic of this situation is that it could take place anywhere in the hospital, they may not have the technology at hand, to open the patient’s record and extract the information required.

That is why we believe that we should take into account some actions that are involved in this kind of situation. They are an important contribution in modelling these scenarios. The unexpected meeting situation serves as a reminder for two or more people on how to solve a particular case and there are two important things to consider when putting it into practice. See Figure 1.

III. CASE STUDY

We have concentrated our efforts on supporting meetings between and among doctors and nurses in a hospital. To achieve this end we have placed some displays with RFID devices in rooms and corridors. Doctors and nurses wearing tags can obtain information about a patient’s record, along with the comments they have prepared before.

Our proposal consists of a public display, integrating a RFID reader and a set of buttons. All of these incorporate wireless capabilities. The system reacts appropriately, identifying people in front of the display, looking for comments made to others in their tag, and showing the information needed to start the informal meeting.

In the following point we present the technology applied, the interaction and the way in which the system offers the information through visualization mosaics.

A. RFID Technology

To create context-aware applications it is necessary to adapt sensorial capabilities to provide implicit inputs to the system in order to achieve natural interfaces closer to the users. With this the proactive aspect of the system is guaranteed.

In Figure 2, three types of devices that we have placed in different contexts can be seen. The first one on the top left presents a contact reader which has an antenna with a reach of only 10 cm. A model of the tag is also shown. This system is ideal for individual use. The next one is a reader and an antenna with a read-and-write capability reaching over 75 cm. This has been specially designed for placing on doors, or near displays [7,8]. It can read several labels simultaneously, when identifying people entering the room.

We use another kind of RFID set, offering more distance between reader and tags (up to 3 meters). At the bottom of Figure 2 a reader and two kinds of tags can be seen. Entry to and exit from each context will thus also be controlled. This
system has a semi-passive tag, using a battery, along with 32 Kbytes of EPROM memory for the user’s data. The reader transmits waves of low frequency 125 Khz. continuously. When a tag detects this wave it activates the microcontroller, sending the required information in UHF frequency. Another feature of our prototype is that it uses Bluetooth to transmit signals from the reader to the computer.

B. The interaction

As we said before, to improve the user-interaction, we have adapted the RFID technology by embedding it in different objects such as credit cards, watches, key rings, etc. The simple action of walking near an antenna allows the system to read and write information in the tags. We have focused the context aspects mentioned before on the identification process, Bravo et al (10, 11, 12, and 13). We aim to make the interaction transparent, non-intrusive and included in the user’s everyday activities. Thus, a doctor wearing tags and walking through the hospital can interact with the environment without any explicit interaction. She or he can also obtain typical identification services such as location, access, presence, inventory, routing, phone call, etc. All of these are obtained with a combination of “who” (doctors and nurses), “where” (anywhere with a display) and “when” (not a concern for this model) concepts of context. With this model we try to solve the matching between these kinds of inputs and outputs. Both of them allow doctors to concentrate on the patient, not on the tool, in a way that is non-intrusive.

In this case, the interaction is reduced to that of approaching a display in the corridor or in the room. So we can talk about embedded interaction taking place in what is a normal activity for doctors and nurses. When an antenna identifies doctors and nurses together near a display and reads the existing comments in their tag, a meeting begins, supported by the display and controlled by the information contained in the tags.

It is obvious that in this kind of informal meeting situation additional interaction is expected. To cater for this, we have placed a number of buttons next to the display with different functionalities. In this way, the control of different information for every patient can be managed. The functionality of each button is adapted to the user according to their particular interaction needs.

Table 1 shows a proposal for controlling the informal meeting through a set of buttons. At the top of this table, the identification to other doctors or nurses in the meeting of the doctor who has made the particular comments, about patients are shown, along with the structure of these. For every comment, the “from” and “to” are included. Added to this, the action, that is, the body of the comment is incorporated. The links with the different elements of the patient’s record are stored in this. Finally, the author of the comment can store it in the receiver’s tag and delete it from his/her own tag. In addition, the four buttons and their functions are included. See Table 1 above. This functionality can change according to the users’ needs.

<table>
<thead>
<tr>
<th>Id.</th>
<th>To Id. (Doctor. or Nurse)</th>
<th>From Id. (Patient)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor Sam Murphy</td>
<td>Dra. Luz Lu You</td>
<td>X-Ray</td>
<td>Zoom</td>
</tr>
<tr>
<td>Nurse Tom Shultz</td>
<td>Nurse Joe Dallas</td>
<td>Diagnostics</td>
<td>Confirm</td>
</tr>
<tr>
<td>Dr. Reeves</td>
<td>Dallas</td>
<td>Confirm</td>
<td>-</td>
</tr>
</tbody>
</table>

C. The Visualization Service

We have placed the RFID devices near the displays in rooms and corridors. These can offer adapted information in a simple and intuitive way through the “Mosaic of Visualization”. These mosaics show the information from the patients’ records in a structured way. In addition, the complement of buttons helps the users to interact according to the functionality of each button defined before.

Figure 3(a) shows how the informal meeting notes and the patient’s record information are displayed. In this figure, the comments of doctors and nurses are presented in the main area. These comments are made with a single tool that stores all the required information in each tag. Also, the effect of interaction can be shown. In this case a zoom-in of an X-ray is presented. See Figure 3(b). In the other areas of the mosaic, data about the patient as regards previous illnesses, treatments, tests, diagnosis, etc. can be managed.

Figure 3. (a) Mosaic with comments (b) Mosaic with X-ray-zoom

IV. RELATED WORKS

One of the most active areas of research in ubiquitous computing is the use of large displays used for information access, management, and sharing. Fusion of displays and identification technology are also interesting areas under study.

In a hospital context, Favela et al [11] integrate public displays with PDA’s. Here, public displays are aware of the presence of doctors presenting personalized information and this allows the transfer of information to and from a PDA in order to have access to clinical information.
IBM developed the Blueboard experiment with a display and RFID tag for the user’s collaboration [12]. This is provided with a RFID tag reader identifying the user and obtaining from a server the individual’s content. Other projects study the conference context domain. Meme Tags propose the use of RFID technology to support the collaboration of tag-wearing-users [13]. The IntelliBadge project also aims to facilitate services to those attending academic conferences, tracking people by RFID tags and showing them information on different displays [14].

MessyBoard [15] and the Notification Collage [16] projects use large shared displays as a means of promoting awareness and facilitating the exchange of information in different types of groups and spaces.

V. CONCLUSIONS AND FUTURE WORK

We have adapted the RFID technology with the aim of improving the interaction between the user and the computer. With these kinds of inputs we are attempting to give solutions to situations arising in the user’s daily activities. In this case, informal meetings among and between doctors and nurses in a hospital context are studied. We have combined the information coming from patients’ records in the hospital database with the private and more specific information included in the individual doctors’ or nurses’ tags.

We need to identify the most suitable RFID set for every hospital ward. The features for each one have to be studied. Another point is that we need to improve the way in which the information in the tag is optimized when supporting all the everyday informal meetings.

REFERENCES